

pilus, and Aster are large genera, and Vernonia provides eight new species. The genus *Quercus* is important both for the number of species and also on account of their dominance in the forests of the area. *Q. alba*, the white oak, *Q. rubra* and *Q. Schneekii*, red oaks, are widely distributed; *Q. macrocarpa*, *Q. platanoïdes*, and *Q. palustris* occur on the coal measures; *Q. acuminata* and *Q. tinctoria* are also common.

The ecological survey is detailed, almost too detailed, as it loses conciseness owing to the multifarious subdivisions. The forests, as the prevailing features of the district, receive the most attention; the cliff and marsh associations are also important. The characters of the various formations are carefully delineated, and the text furnishes an estimable addition to the literature of plant distribution, but the area has apparently not been surveyed with the view of plotting on a map, nor are any illustrations provided.

The Evolution of Matter, Life, and Mind. By W. Stewart Duncan. Pp. 250. (Philadelphia: Index Publishing Company, 1907.)

THIS is a *vade mecum* of evolutionism, a sequel to a previous volume in which the author sought to show that feeling and energy are alternate states of matter everywhere. Feeling is given out as energy, and energy is experienced as feeling. Both are spiritual or non-substantial, sister properties or manifestations capable of inhering and co-inhering in one universal substance, the ether. The progress of investigation has enabled the author to make his monism even more definite. Matter is being refined away into a mode of motion in the ether. This ether is "the fountain of all being," "the hitherto unknown God." Prof. Larmor and others are theologians in spite of themselves. Helped by abundant quotations, Mr. Duncan gives a sketch of recent investigations as to the nature of matter, and he points out that he anticipated some of them. In 1893, for instance, he contended that an ordinary ray is a succession of such motions of the ether as beget waves with *longitudinal* as well as *transverse* elements of vibration, and it was only last year that Prof. J. H. Poynting showed that rays of light do exert energy in the direction of propagation. In the present volume he develops some original speculations, e.g. a theory of radiation and gravitation.

The author tells us that we must believe in the spirituality of matter and of the ether. Physical processes are *never* complete chains of sequence. Feeling and energising arise alternately in all matter. Animal matter has sprung from vegetable matter, and the latter from inorganic matter (in the Arctic regions). All that we call "matter" is at least sensitive and capable of feeling. It is so because of what it produces, and it is so because the ether is the fountain of all being, physical and mental. Every receiver of energy passes through two states, which correspond to those of every living personality, a subjective state of feeling which results from influence from without, and an elective state of energising which results from influence from within. We trust that this is all quite clear.

Mr. Duncan gives an account of the origin of everything—including evil—except the ether, which is a scientific name for God. He traces the evolution of all living creatures and of the human mind, showing that the difficulty of thinking out the long genetic process may be in great measure overcome if we start from a broad enough basis—the psychosis of "matter." In the course of his exposition he quotes the story of a delightful orchid, discovered by Mr. E. A. Suverkrup, of Philadelphia, which sends down a tubular stem into the water when it is thirsty, fills

the tip, and coils it up again. "As the last coil is made the water trickles down upon the roots at the other end." When the discoverer touched the leaves, he was "astonished to see the centre stem convulsively coil itself into a spiral like the spring of a watch." Wonders will never cease. Nor is pathos wanting, for on dry ground "it was almost pitiable to see how the tube would work its way over the ground, in search of water that was not."

Ballistic Experiments, from 1864 to 1880. By the Rev. Francis Bashforth. Pp. 33. (Cambridge: University Press, 1907.) Price 1s.

THE pamphlet is interesting reading as an unconscious revelation of the timidity of thought of our military authority. Afraid to trust its opinion, it waited for approbation to come from abroad before expressing a judgment.

Although carried out with our muzzle-loading guns, Mr. Bashforth's experiments were so careful as to require slight modification only to serve for the newest pattern of modern artillery, and the arrangement of his tabular matter for practical use has been adopted universally, and is never likely to be displaced.

Mr. Bashforth is the creator of the science of modern artillery, but our official world considers this a very improper remark to make, at least in his lifetime.

The rapid progress in electromagnetic science has made possible a great improvement in the chronograph, and further experiment is needed urgently if we are to make the best use of manufacture in the production of improved weapons of war.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

The Origin of Radium.

IN his two interesting letters published in NATURE of September 26 and October 10 respectively, Dr. Boltwood states that he has obtained undoubted proof of the existence of the parent substance of radium, and that he finds it to be allied in chemical properties with thorium. I may be permitted to describe some experiments which afford independent evidence that the parent substance of radium possesses in a chemical sense the properties of thorium, and that it occurs with the latter.

In experiments made with a new intermediate product obtained from thorium to which I have given the name "mesothorium," I was struck by the fact that old preparations of pure thorium contained relatively large quantities of radium. This appeared all the more noteworthy since the monazite sand from which the thorium is prepared contains only a very small quantity of uranium; the radium corresponding to this small amount must consequently have been separated from the thorium during the complicated processes used in extracting the latter.

A few months ago, therefore, I began a systematic investigation of the quantity of radium in samples of thorium salts of different ages. A weighed quantity of the pure nitrate, generally 10 grams, was dissolved in pure water, and the solution boiled and sealed up. After a sufficient interval the radium emanation was collected by boiling the solution, and shortly afterwards, after allowing the thorium emanation to decay, transferred to an electroscope and measured. Samples of thorium nitrate of very different but accurately known ages were placed at my disposal by the firm of Dr. O. Knöfler. It was found as a result that the older the sample the larger was the quantity of radium contained in it. The oldest sample of all, one dating from 1898, contained the greatest amount. In quite a new sample the quantity of radium was very small, 100 grams of the sample

being required for its measurement. The radium present in this case was about 1/100 that contained in the sample nine years old.

It was not to be supposed that an insufficient degree of purity was the cause of the large amount of radium in the old sample, nor is it probable that thorium itself slowly decomposes into radium. I therefore considered that in the technical preparation of thorium an active substance is separated with the latter, and in turn decomposes into radium; it is probably the direct parent substance of radium, for which search has been recently made. In order to test this view, an attempt was made to show the increase in the amount of radium in a solution of thorium; 100 grams of freshly prepared thorium nitrate was examined, the quantity of radium being ascertained. The amount of emanation collected after four days was used for calculating the equilibrium amount, which is reached after about a month. On August 17 the flask was sealed, and again tested on October 10; the amount was double as great as in the previous test.

Forty grams of thorium nitrate prepared at the end of April was examined in the same way and left during the vacation. In this case also there was a marked increase in the amount of radium.

Fifty grams of thorium nitrate made in June, 1907, was precipitated from acid solution with oxalic acid. In the filtrate the quantity of radium was determined, the same being also done in October. In each case the same result was obtained. The parent substance of radium had therefore been precipitated with the thorium. By mistake, the precipitated material was mixed with other thorium preparations, and could not, therefore, be further investigated.

About 1 mg. of radio-thorium (activity about 100,000) was freed as far as possible from radium (the small amount retained being determined) and sealed up on August 15. The solution on October 14 gave the same amount of radium emanation as before. The radio-thorium was prepared from thorinite by means of barium sulphate, and should not, therefore, have contained the parent substance of radium, as, indeed, was actually found to be the case.

Knowing the proportion of uranium and thorium in monazite sand, and assuming that all the thorium and the whole of the parent substance of radium are separated during the extraction of thorium, the life of radium can be calculated by determining the quantity of radium in a given weight of thorium of known age. I have assumed the monazite to contain on the average 0.3 per cent. of uranium and about 5 per cent. of thorium oxide. From this it follows that 1 gram of thorium nitrate in equilibrium with radium contains about 2.10^{-8} gram of radium bromide. From the values I have found with samples of thorium of different age, the period of decay for radium lies between 2000 and 3000 years. Alterations in the proportions of uranium and thorium would naturally cause corresponding deviations in the value of the constant. The values given, therefore, only indicate approximately the order of magnitude of the period of decay, since I am ignorant of the exact composition of the monazite used as a source of the nitrates investigated.

I hope to publish more accurate details shortly in another place.

OTTO HAHN.

Chemical Institute, Berlin.

The Victoria Jubilee Technical Institute, Bombay.

I SEE in NATURE of November 7 advertisements for a principal and professor of chemistry for the Victoria Technical College in Bombay. Though I have no connection with the institute, and may be charged with unwarrantable interference, I think that it is only fair to intending competitors that certain facts should be made known.

I wish to point out, in the first place, that the management of this institution is in the hands of a board of trustees, and that the principal is not a member of this board, nor has he the right of communicating with the board except through the medium of the honorary secretary. The title of principal does not even secure to the holder of it the exclusive right of calling meetings of the staff, and, in fact, confers nothing more than the power

to enforce discipline. On the occasion of the opening of the new laboratories in February last, I was much impressed by the fact that not only was the principal not among the speakers, but that he and his staff were barely referred to, and that their names only appeared in the descriptive pamphlet which was published for the occasion inside the cover and at the end.

Such were the conditions under which my friend Dr. Mackenzie held the appointment, and it was with no astonishment that I heard on my return from India that he had sent in his resignation. I may add that though Rs. 1000 per mensem with a residence appears to be a good salary, it must be remembered that there is no security of tenure of the appointment, and that the residence offered to Dr. Mackenzie lay between the dustiest road and the busiest railway in the heart of Bombay.

Should any chemist contemplate applying for the "chair" of chemistry with the view of carrying out research in his spare time and ultimately improving his position, I should like to remind him that he will do well to take his library with him. There are no scientific books in Bombay.

Before leaving Bombay I made it clear to some of my friends who are interested in the institute that, in the event of Dr. Mackenzie's resignation being accepted, I should make the facts public, and should warn other scientific men against accepting the appointment upon similar terms.

MORRIS W. TRAVERS.

London, November 9.

November Meteors.

THOUGH the general conditions under which the Leonid meteor shower of 1907 takes place are not the most favourable, still a display of moderate intensity may be expected. The shower promises to be most conspicuous on the night of November 16, when moonlight will interfere considerably with observations, especially in the case of the smaller meteors. The following are the times of the various maxima as computed by the writer, the results of these calculations being expressed in Greenwich mean time:—

Leonid epoch, November 15, 9h. The shower, which is of the third order of magnitude, succeeds the epoch, the principal maxima occurring on November 16, 17h., 17h. 30m., and 18h. 30m. There is also a weak secondary epoch on November 17, 10h., the shower in this case preceding the epoch, and having its principal maxima on November 16, 13h. 40m., 18h., and November 17, 2h.

The intensity of the maxima of a meteoric epoch is inversely as the order of magnitude of the shower connected with it. Two showers, though of different intensities, will, as may be seen, take place on the night of November 16.

Scattered through the rest of the month are several interesting minor showers, details of the most remarkable of which will now be given:—

Epoch, November 22, 4h. Shower of tenth order of magnitude. The shower precedes the epoch, the principal maxima occurring on November 20, 8h., November 21, 14h., and November 22, 3h.

Epoch, November 25, 12h. This shower, which is of the ninth order of magnitude, has its principal maxima after the epoch as follows:—November 26, 1h. 50m., November 27, 2h. 30m. and 6h. Of these, the latter two are the heaviest maxima.

Epoch, November 29, 18h. The shower, which is of the fifteenth order of magnitude, follows the epoch, the principal maxima occurring on November 29, 23h., November 30, 18h., and December 1, 4h.

Closely associated with the last shower is another, which occurs early in December, is of the fifth order of magnitude, and has its maxima on December 2, 11h., and December 3, 8h.

JOHN R. HENRY.

An Optical Illusion.

THE optical illusion described by Mr. Douglas Carnegie in NATURE of October 18, 1906, may be explained as follows:—

The thaumatrope generally reverses its apparent direction of rotation when the observer shuts one eye, or, better still, both eyes alternately, according to the physiological